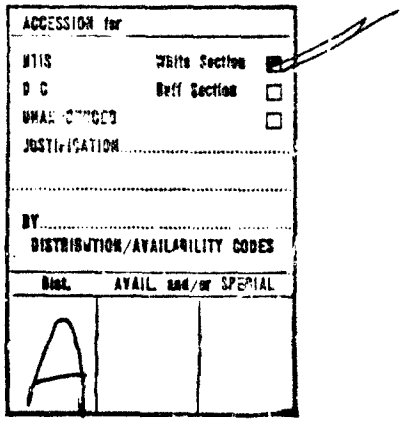
SUMMARY OF THE HUMAN ENGINEERING LABORATORY'S AIR-TO-GROUND TARGET DETECTION STUDIES USING STATIONARY TARGETS

Human Engineering Laboratory
Aberdeen Proving Ground, Maryland

March 1974



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The Human Engineering Laboratory (HEL) has conducted a number of air-to-ground target detection/identification studies since 1962. Each study was conducted using stationary, passive, noncamouflaged military ordnance type targets, but the type of helicopters ranged from the OH-13 for the 1962 study through the UH-1 to the OH-58 for the 1974 study. This report summarizes these findings.

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SUMMARY OF THE HUMAN ENGINEERING LABORATORY'S AIR-TO-GROUND TARGET DETECTION STUDIES USING STATIONARY TARGETS

The Human Engineering Laboratory (HEL) has conducted a number of air-to-ground target detection/identification studies since 1962 (Table 1). Each study was conducted using stationary, passive, noncamouflaged military ordnance type targets, but the type of helicopters ranged from the OH-13 for the 1962 study through the UH-1 to the OH-58 for the 1974 study.

Recent events have increased interest in the ranges at which the helicopter crewman can be expected to detect and/or identify a target.

The Human Engineering Laboratory's studies of air-to-ground target detection identification have all concluded with essentially the same results; a stationary, passive, noncamouflaged military ordnance type of target can be detected by an observer in a slow speed, 60 knots, low flying, less than 300 feet, helicopter at maximum ranges up to 2000 meters but cannot be reliably identified at ranges greater than 1000 meters.

Terrain and terrain cover play a very important role in the detection/identification problem. Figure 1 indicates that at flight levels between 100 feet and 300 feet there is somewhere between 40 percent and 85 percent of smooth terrain visible. When the terrain becomes moderately rough, the availability drops to between 20 percent and 38 percent. The effect of terrain cover is shown in Figure 2 which indicates a 90 percent availability of targets at a 1000 meter range and a 300 foot altitude where there is no foilage, when there is foilage the availability drops to 30 percent.

TABLE 1

Human Engineering Laboratory's
Target Detection/Identification Studies

January	1962	Helicopter Armament Program. Air-To-Ground Target Detection and Identification. C. G. Moler. TM 1-62
June	1965	Development of an Air-To-Ground Detection/ Identification Model. M. E. Franklin and J. A. Whittenburg. HSR-RR-65/4-Dt.
January	1966	Acquiring and Relocating Targets from a Helicopter: A Preliminary Investigation. R. A. Monty, S. A. Hicks, C. G. Moler. TM 2-66
January	1973	Air-To-Ground Target Identification Using Stabilized Optics. H. L. Cheever and G. L. Horley. TM 2-73
January	1974	HELHAT II, Scout Crew/Observer Target Detection Flight Tests. TN 1-74

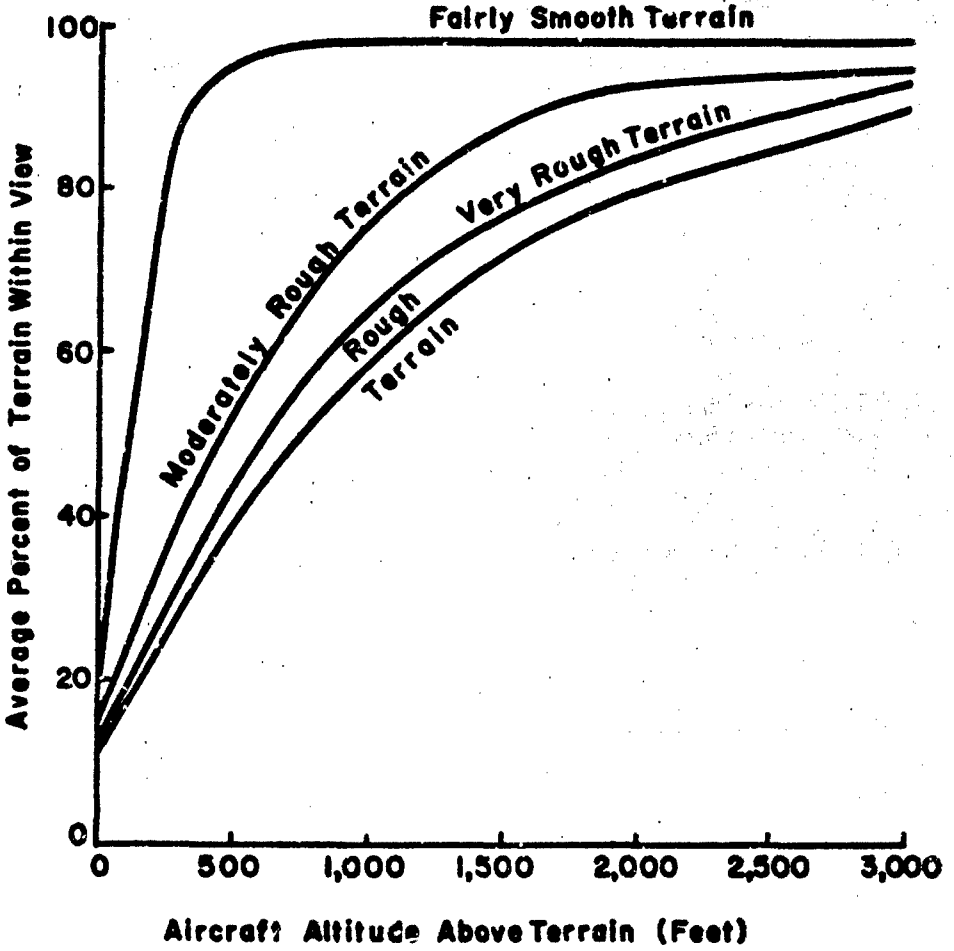

Fig. 1. Average percentage of terrain seen from aircraft as a function of type of terrain and altitude (redrawn from Erickson, 1961).

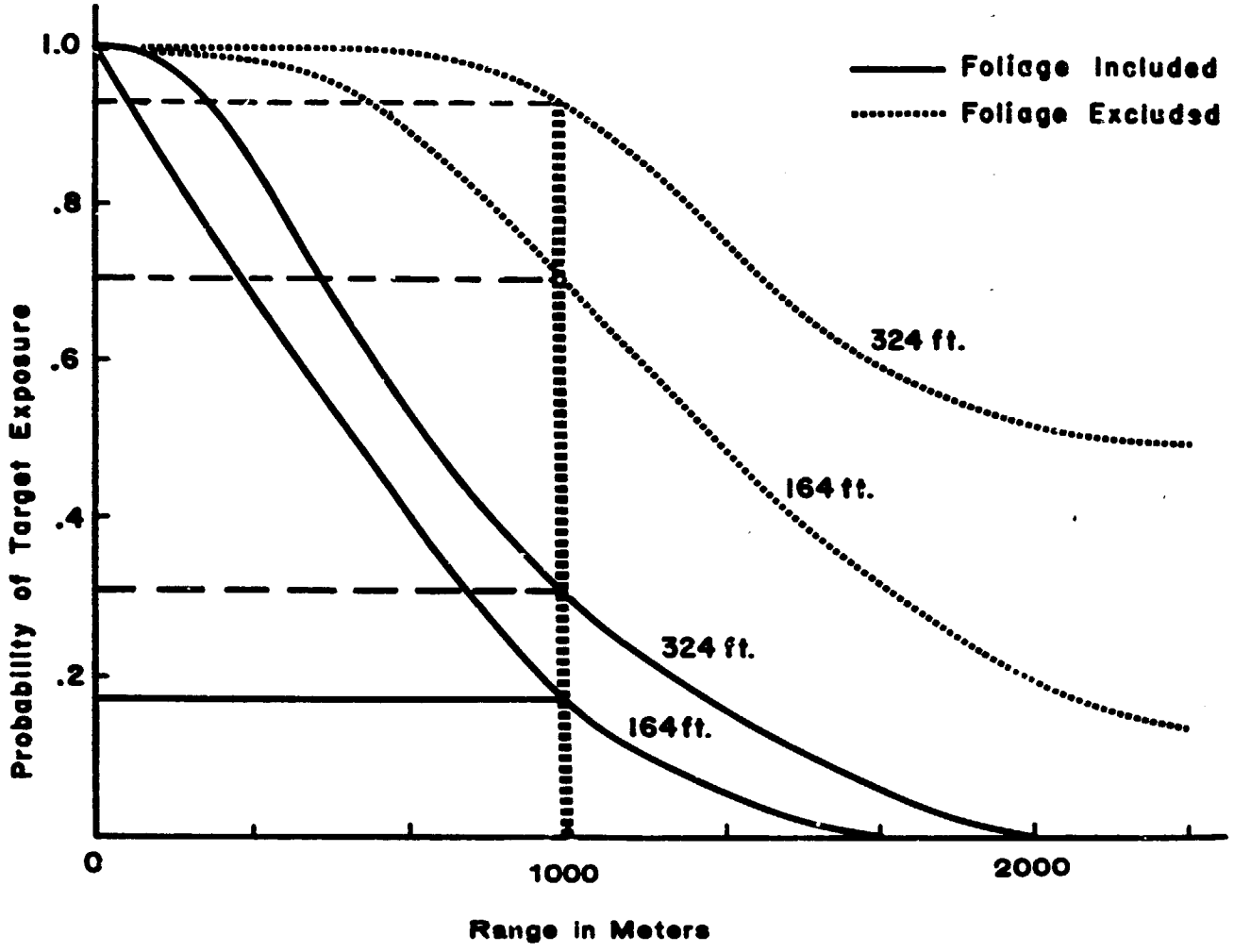

Fig. 2. Average probability that a 7-foot target is exposed as a function of range and altitude with foliage included and excluded (redrawn from Ballistics Analysis Laboratory, 1959). Altitude is shown on each curve.

Target .... Tank, Stationary
Terrain ... Rolling
Altitude ... 100 ft.
Speed ..... 100 m. p. h.

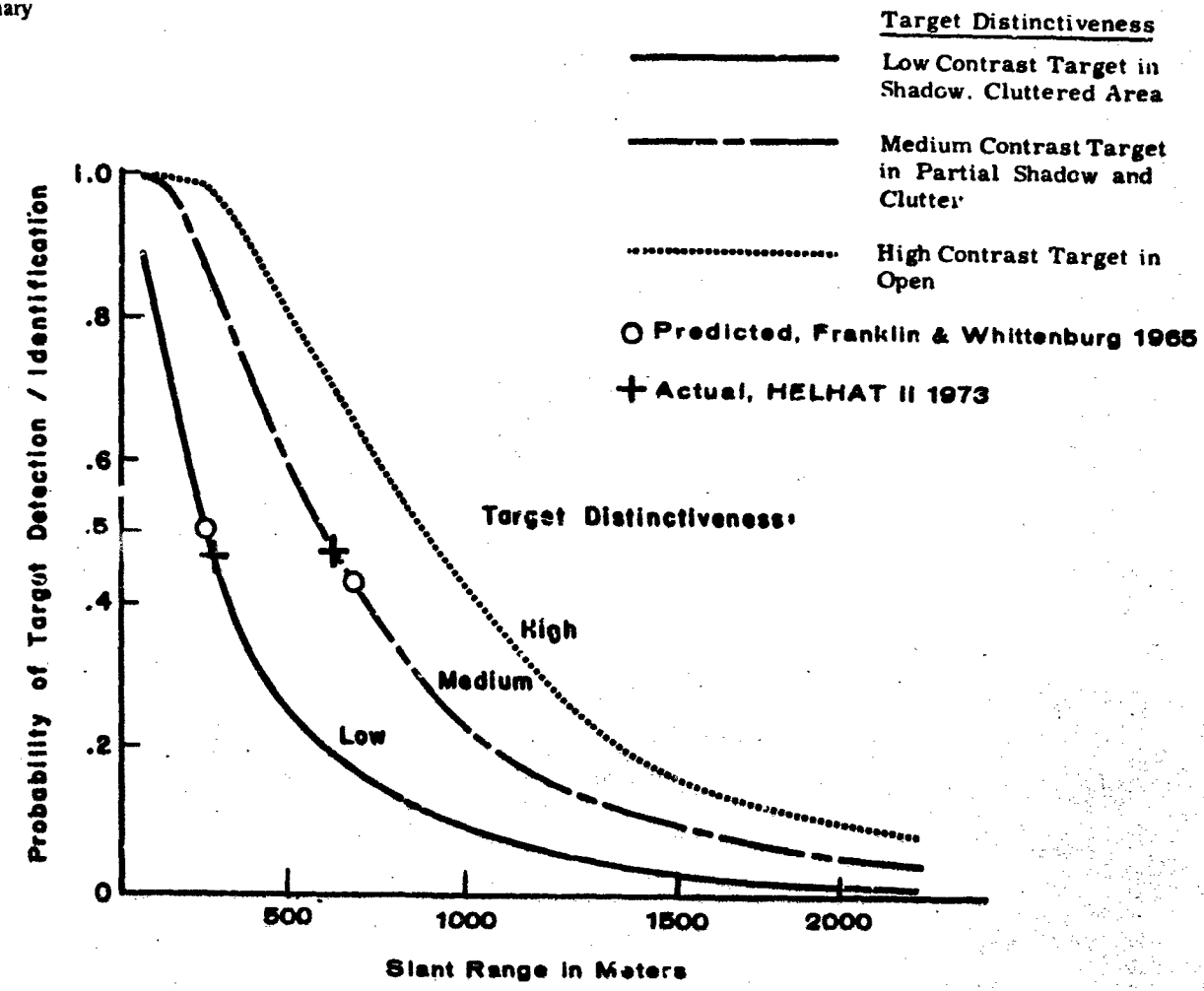

Fig. 3. Target distinctiveness.

It can also be determined from Figure 2 that at a 100-foot altitude the availability values become 70 percent and 15 percent respectively.

Considering these experimental findings the values shown in Figure 3 become more understandable. Given a tank on rolling terrain; about 40 percent of the terrrain is visible from a 100-foot altitude and the medium contrast or part cover gives a 60 percent availability of the targets to be seen, therefore at 1000 meters these values should give a 24 percent probability of detection with about a 48 percent probability of detection at 500 meters. The actual overall detection value found in HELHAT II was 46 percent and the predicted value from a previous HEL study, HSR-RR-6514-Dt, was 45 percent.

As the cover increases the detection range will decrease if one is to maintain a 46 percent probability of detecting stationary ordnance type targets.

Figures 4 and 5, from a 1973 HEL study, TM 2-73, show the probability of identifying a stationary target after detection when flying at 1500 feet using variable, 1.5x to 20x, optics. Comparing this with similiar work done by Blackwell and others in 1958, Figure 6, we see that optics were relatively ineffective as an aid to the identification of passive targets until the range was less than 1500 meters and achieved an acceptable value only at ranges less than 1000 meters.

The overall results of the studies conducted at HEL since 1962 indicate that when considering the detection and identification of stationary targets from low flying helicopters, at above the ground levels of 100 to 300 feet, and speeds of 50 to 100 knots, the detection/identification range for military ordnance emplaced on fairly smooth terrain with light to moderate ground cover will rarely exceed 1000 meters and more than likely will be closer to 500 meters.

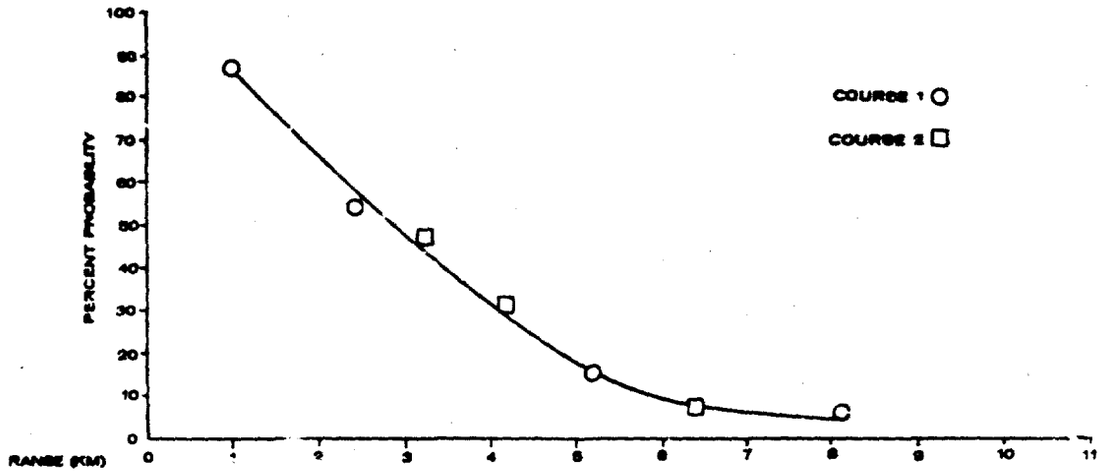

Fig. 5. Cumulative probability of a correct-by-name troop[1] identification versus slant range.

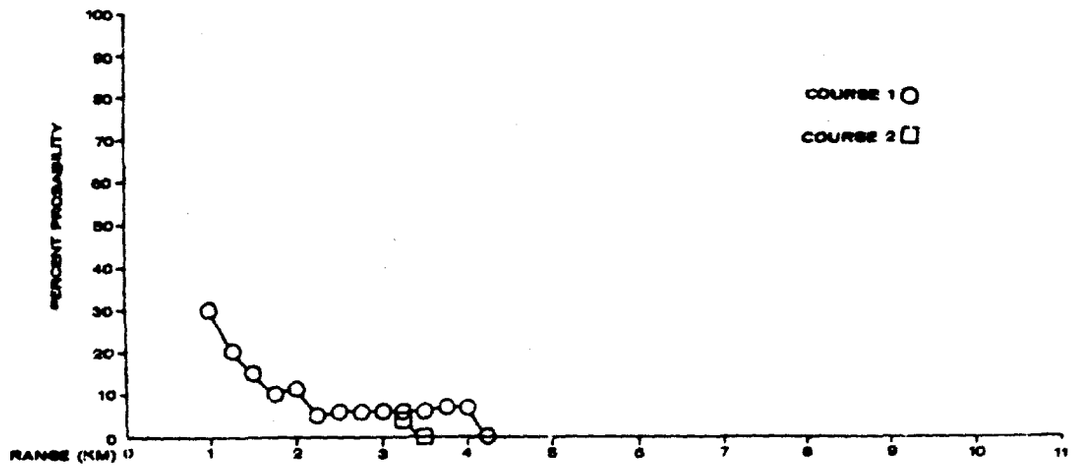

Fig. 4. Approximate cumulative probability of a correct-by-nation[1] vehicle identification versus slant range.

[1]US and USSR.

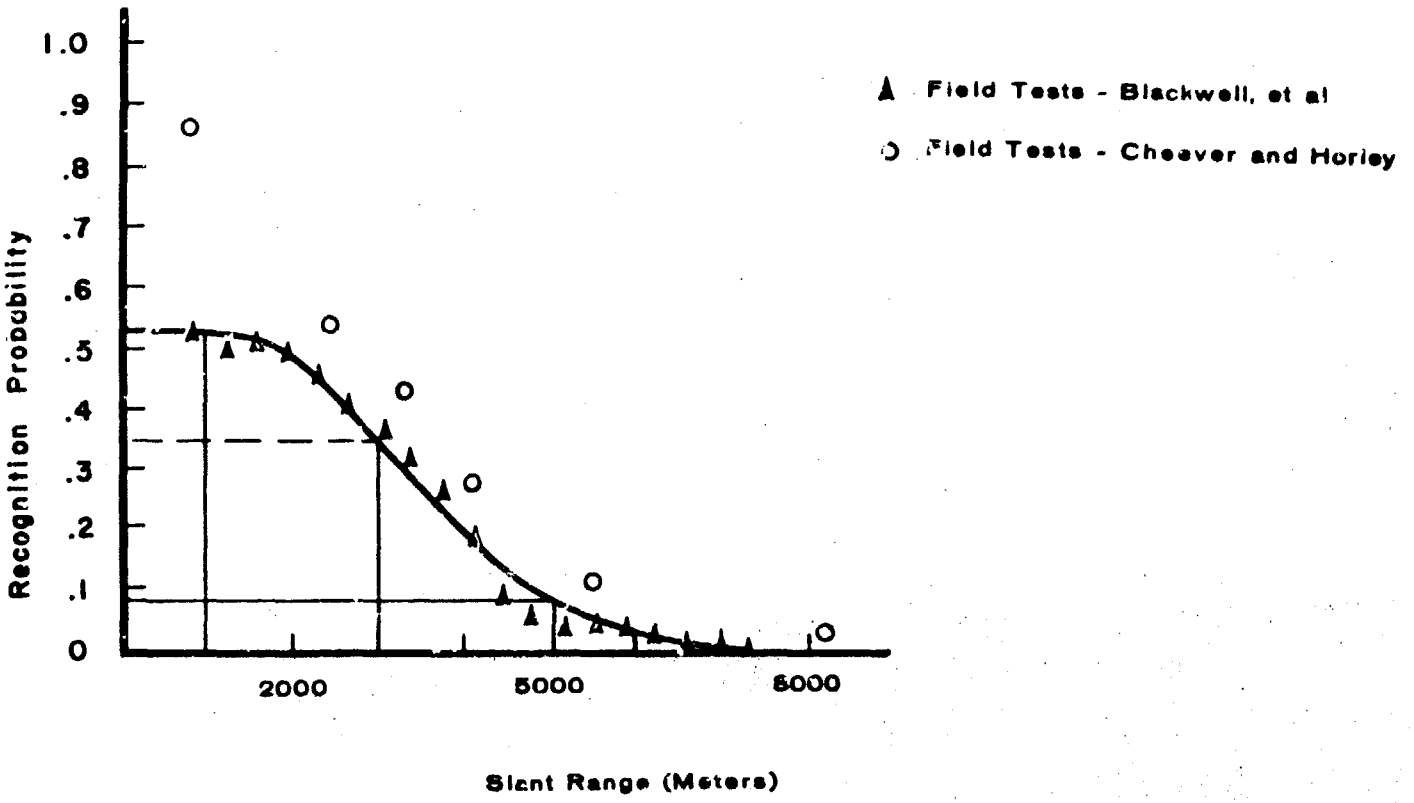

Fig. 6. Recognition probability as a function of slant range--field and simulator data (from Blackwell, et al., 1958).

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